

Notice of Allowability

Application No.

10/627,611

Examiner

Chih-Cheng Glen Kao

Applicant(s)

WATANABE ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/16/06.
2. ☒ The allowed claim(s) is/are 2-9 and 11-20.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some* c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____ |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2. The application has been amended as follows:

In claim 20, line 9, replace "first-X-ray" with --first X-ray--.

In claim 20, line 12, replace "first-X-ray" with --first X-ray--.

Reasons for Allowance

3. Claims 2-9 and 11-20 are allowed. The following is an examiner's statement of reasons for allowance.

4. Regarding claim 7, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming a laminated X-ray absorber on a surface of an X-ray transmitter, but not in recesses, wherein said laminated X-ray absorber includes at least two layers having different compositions, wherein phase shift of X-rays transmitted through said X-ray absorber is in a range of 0.3π to 0.6π and transmittance of the X-rays transmitted through said X-ray absorber is in a range of 30% to 60% for X-rays having an average exposure wavelength longer than 0.3 nm and shorter than 0.7 nm, in combination with all the limitations in the claim. Claims 2-6, 8, and 19 are allowed by virtue of their dependency.

5. Regarding claim 9, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming a second X-ray absorber on a first X-ray absorber, said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion being disposed on a corresponding one of first X-ray absorber portions, each second X-ray absorber portion having side surfaces substantially transverse to an X-ray transmitter and a second width measured between the side surfaces of the second X-ray absorber portions, the second width being larger than a first width and none of the side surfaces of the second X-ray absorber portions being contiguous with side surfaces of the first X-ray absorber portions, in combination with all the limitations in the claim. Claims 17 and 18 are allowed by virtue of their dependency.

6. Regarding claim 11, prior art fails to disclose or fairly suggest a method of fabricating a semiconductor device, including carrying out an exposure with an X-ray mask having a geometric X-ray phase difference between the phase of X-rays transmitted through an X-ray transmission part of said X-ray mask and the phase of X-rays transmitted through an X-ray absorber of said X-ray mask in a range including 0.5π and in proximity to 0.5π , wherein a laminated structure includes at least two layers having different compositions, and either the phase shift of the X-rays transmitted through said X-ray absorber is in a range of 0.3π to 0.6π or the transmittance of the X-rays transmitted through said X-ray absorber is in a range of 30% to 60%, in combination with all the limitations in the claim. Claims 12 and 13 are allowed by virtue of their dependency.

7. Regarding claim 14, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming a second X-ray absorber on a first X-ray absorber, said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion being disposed on a corresponding one of first X-ray absorber portions, each second X-ray absorber portion having a second width, larger than a first width, wherein tungsten is employed as one of said first and second absorbers, and diamond is employed as the other of said first and second X-ray absorbers, in combination with all the limitations in the claim.

8. Regarding claim 15, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming an etching stopper film, stopping etching when etching a first X-ray absorber on an X-ray transmitter, and forming a second X-ray absorber on said etching stopper film on said first X-ray absorber, said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion being disposed on a corresponding one of first X-ray absorber portions, each second X-ray absorber portion having a second width, larger than a first width, in combination with all the limitations in the claim.

9. Regarding claim 16, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming an interlayer film as an etching stopper or a hard mask on a first X-ray absorber, and forming a second X-ray absorber on said interlayer film on said first X-ray

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absorber, said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion being disposed on a corresponding one of first X-ray absorber portions, each second X-ray absorber portion having a second width, larger than a first width, in combination with all the limitations in the claim.

10. Regarding claim 20, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming a second X-ray absorber of a second X-ray absorbing material, different from a first X-ray absorbing material, on a first X-ray absorber, said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion being disposed on a corresponding one of first X-ray absorber portions, each second X-ray absorber portion having a second width, larger than a first width, in combination with all the limitations in the claim.

11. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER